

# Z(ee)+Jets Analysis

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→ Electron Eta  
horns ...



# Samples

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- **Data:**
  - EM1TRK skim
  - Single EM triggers
  - Run range: 20 April 2002 - 28 June 2004 (Runs 151,817 - 194,566)
  - Rejecting bad runs (CAL, SMT, CFT, Jet/Met, Lumi)
  - $323\text{pb}^{-1}$
  - No T42 applied
  - Jetcorr v5.1
  - Processed with ATHENA (v01-05-02)
- **MC:**
  - $Z/\text{Gamma}^* \rightarrow e^+e^- + X$ : 400k Pythia
  - Processed with ATHENA (v01-05-02)



# Selection Criteria

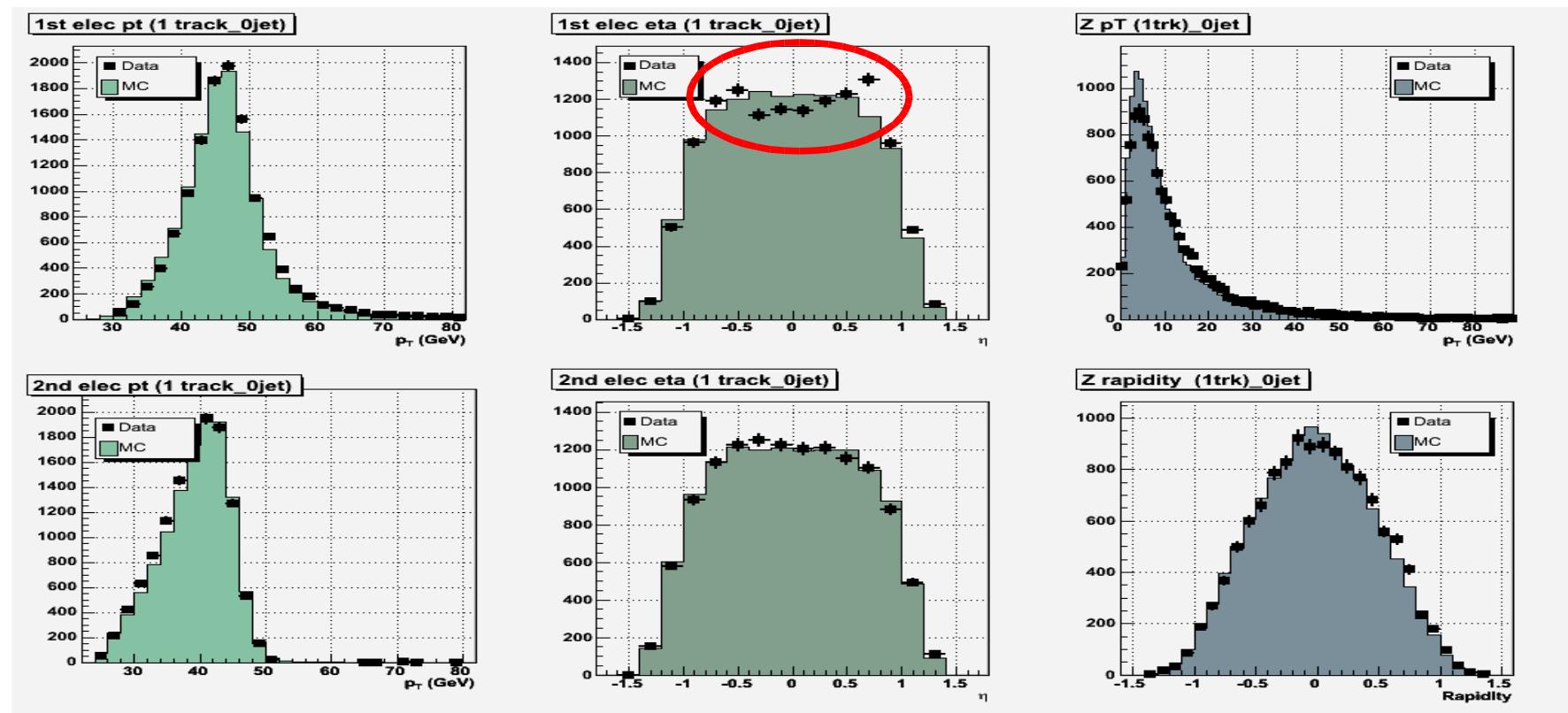
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- Removing bad runs/LBNs & dupli events
- PVX cut:  $|z| < 60\text{cm}$
- Using unprescaled single EM triggers
- Electron selection:
  - $|ID| = 10, 11$
  - $\text{EMF} > 0.9$
  - $\text{Iso} < 0.15$
  - $\text{HM}_k(7) < 12$
  - $p_T > 25\text{GeV}$
  - $|\eta| < 1.1$
  - Including phi cracks
- Z selection:
  - $75\text{GeV} < M_{ee} < 105\text{GeV}$
  - At least one trackmatched electron
  - At least one electron needs to fire the trigger
- Jet selection:
  - $0.05 < \text{EMF} < 0.95$
  - $\text{HotF} < 10$
  - $N_{90} > 1$
  - $\text{CHF} < 0.4$
  - L1conf
  - JES corrected  $p_T > 20\text{GeV}$
  - $|\eta| < 2.5$
  - Removal of jets overlapping with electrons from Z within  $dR$  of 0.4



# Data vs MC

- MC = Pythia sample
- MC: smearing:  $pT' = pT c [1 + \text{Gauss}(0, f)]$        $c = 1.003, f = 0.045$
- Data: background subtracted based on sidebands (40-75GeV & 105-140GeV)
- Normalization between data and MC wrt area (shape comparison)



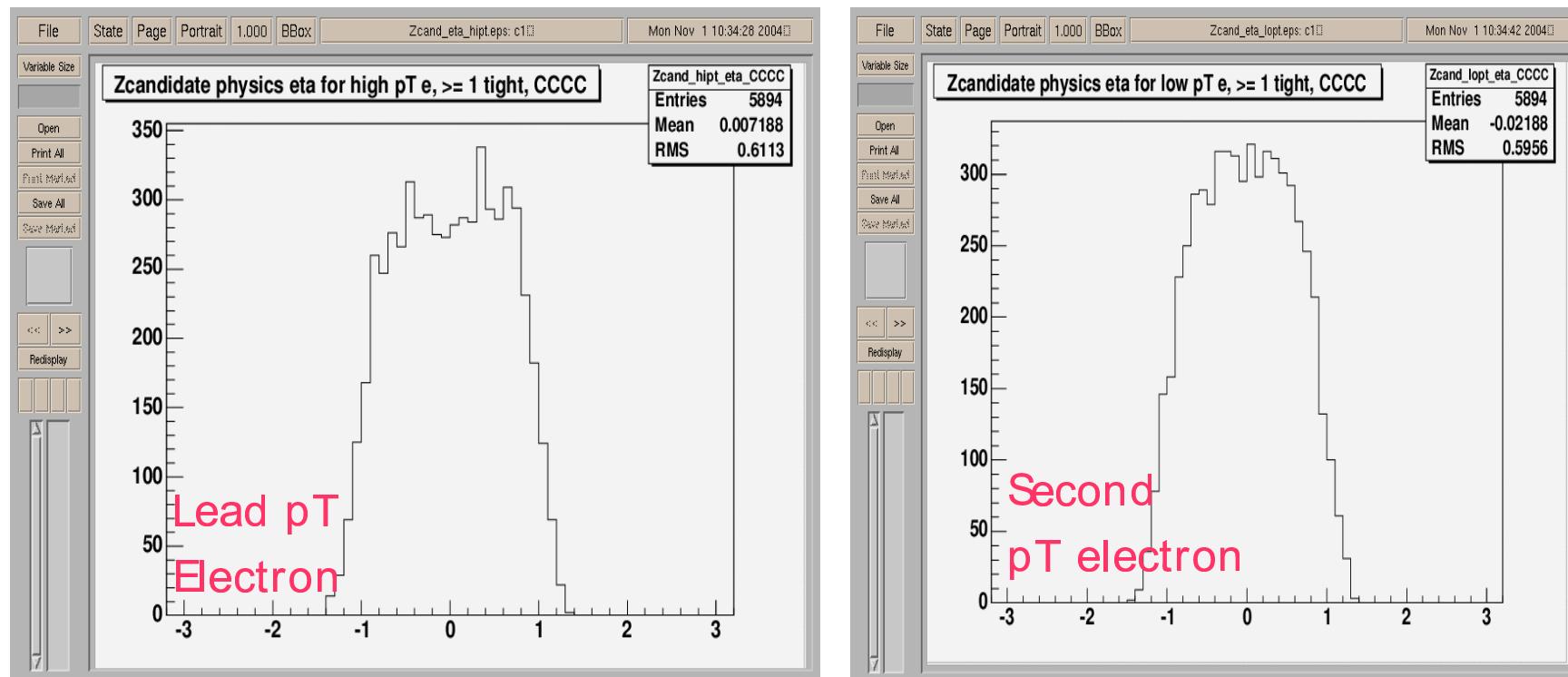
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# Comparison with Electroweak Group (John Gardner)

- same electron quality cuts
- $pT > 25 \text{ GeV}$
- CCCC electrons
- not applying bad-CAL-map (with bad-CAL-map horns are still there!)
- smaller dataset ( $177 \text{ pb}^{-1}$ )



# Some basic checks

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- ✗ Electron pt vs electron eta
- ✗  $|PVZ| < 20\text{cm}$
- ✗  $|\eta| < 0.8$
- ✗ Module 17
- ✗ Phi cracks
- ✗ Electron pT cut
- ✗ Mass window cut
- ✗ Jet Multiplicities
- ✗ Track matching
- ✗ Runrange dependence

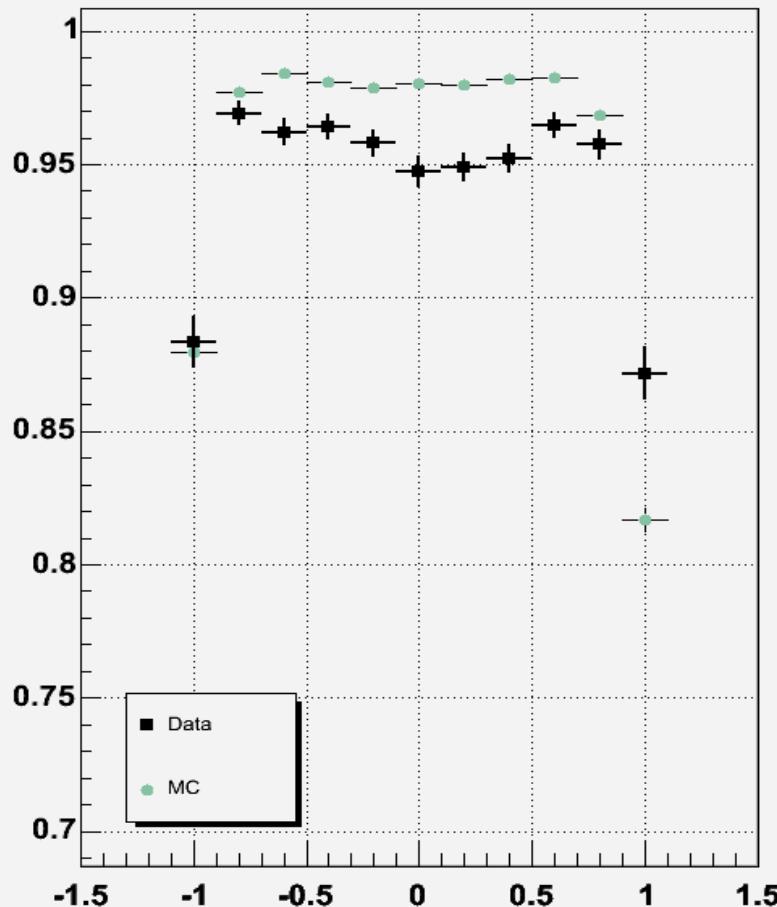
See plots at the end of this talk ...



# EM- and Reco efficiencies vs Eta

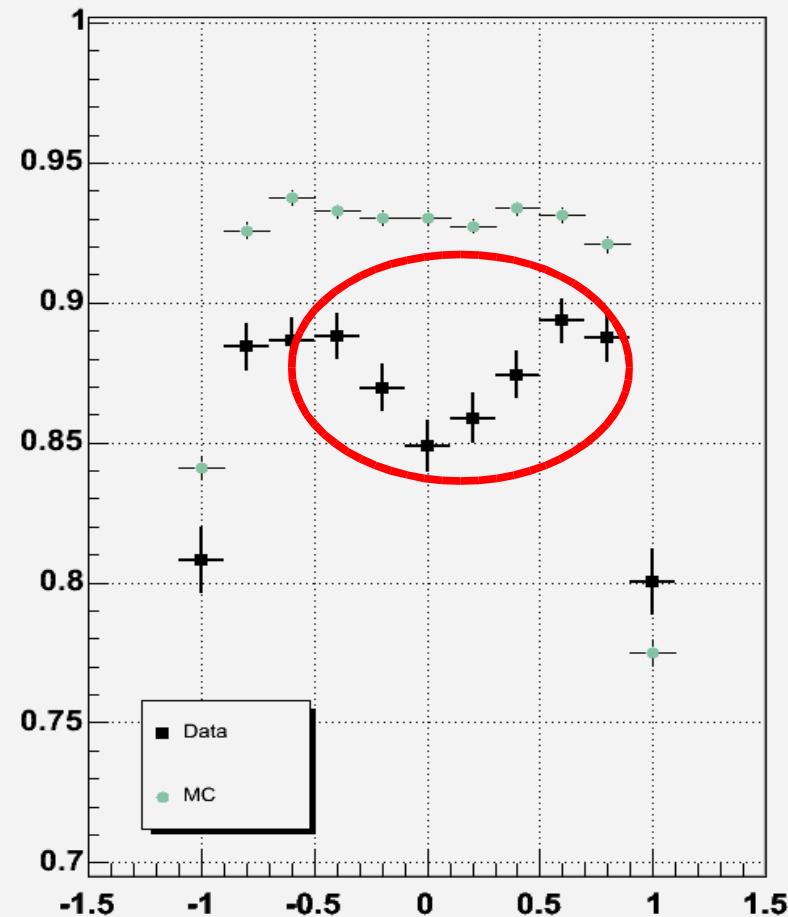
eff\_reco\_eta\_0jet

Reco



eff\_EM\_eta\_0jet

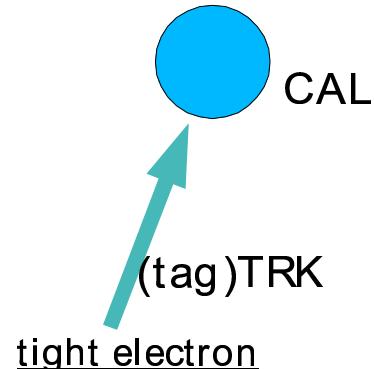
Reco x ID



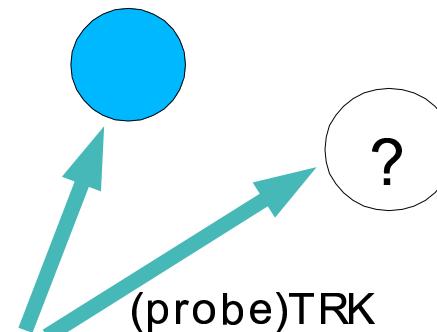
# Tag & Probe Method Overview

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Tag:



Probe:



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## Z(ee) + n Jets Analysis Cuts:

PVX < 60cm

**Tag-Electron:** EMF > 0.9, Iso < 0.15, HMX7 < 12.,  $p_T$  > 25 GeV,  $|\eta| < 1.1$ , **with phi cracks,**  
matched with a good track in  $\Delta R(<0.14)$

**Trigger:** tag electron is required to have fired single electron trigger

**Tag & ProbeTracks:**  $25 \text{ GeV} < p_T < 80 \text{ GeV}$ , Chi2 < 8.0,  $|DCA0| < 0.3$ ,  $|DCA1| < 4.0$ ,  $|\eta| < 1.1$ , **with phi cracks**

**Probe:** Good track separated from Tag by  $\Delta\Phi > 2.0$

**Background reduction:** Opposite signed tracks, MET < 15 GeV

**TagElec-ProbeTrack-inv mass cut:**  $70 \text{ GeV} < M_{ee} < 110 \text{ GeV}$

**Reco matching cone:**  $dR = \sqrt{(\Delta\eta^2 + \Delta\Phi^2)} = \sqrt{(.1^2 + .1^2)} = 0.14$

**Jets:**  $0.05 < \text{EMF} < 0.95$ , HotF < 10.0, N90 > 1, CHF < 0.4, L1conf,  $p_T > 20.$ ,  $|\eta| < 2.5$ , not counting jets

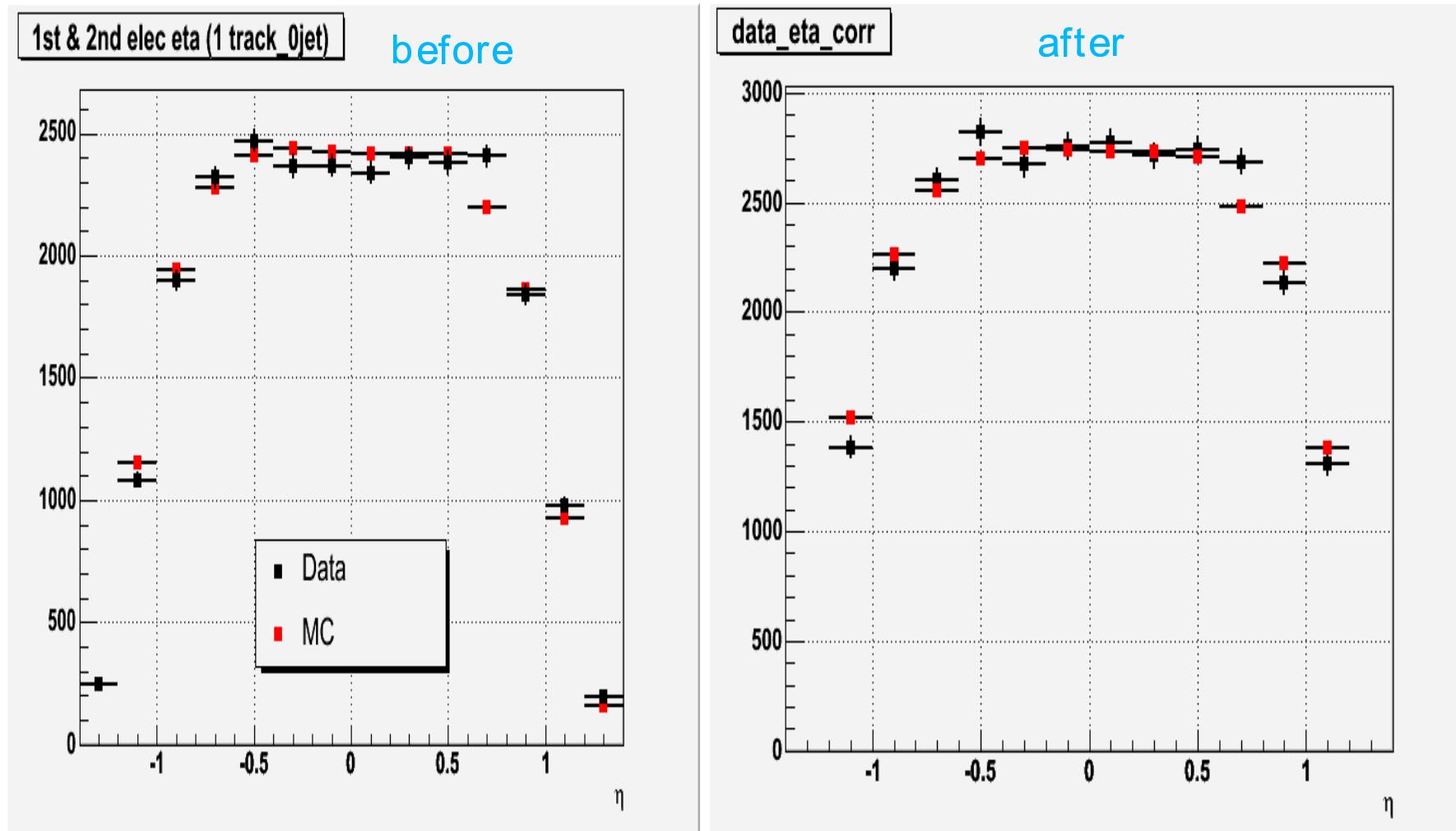
overlapping with probe tracks within  $\Delta R < 0.4$

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# Correcting for Reco x ID inefficiencies

Combining 1<sup>st</sup> & 2<sup>nd</sup> electron

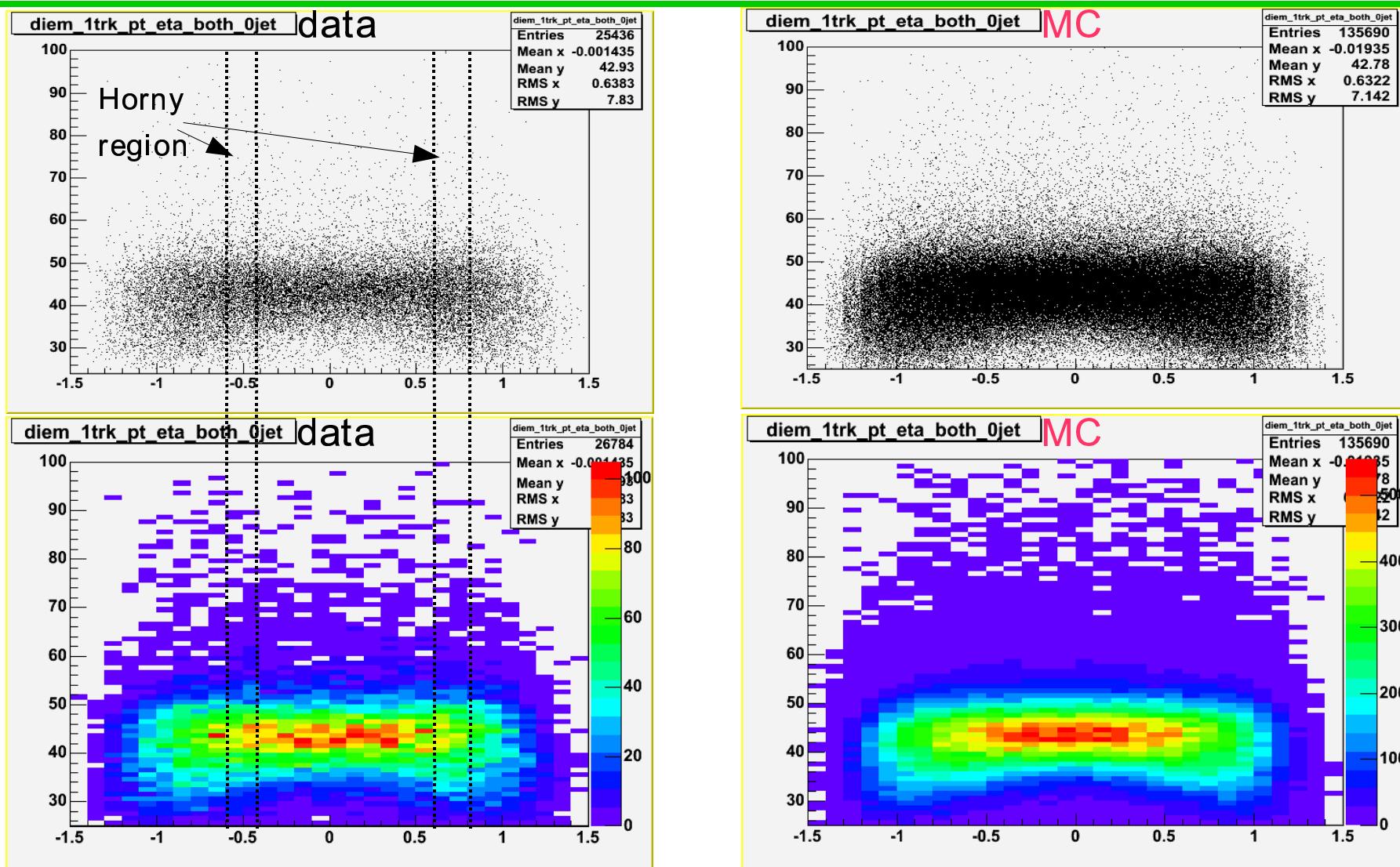


# Summary

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- Are electron eta horns observed in other analyses ?
- What's causing the eta horns ???

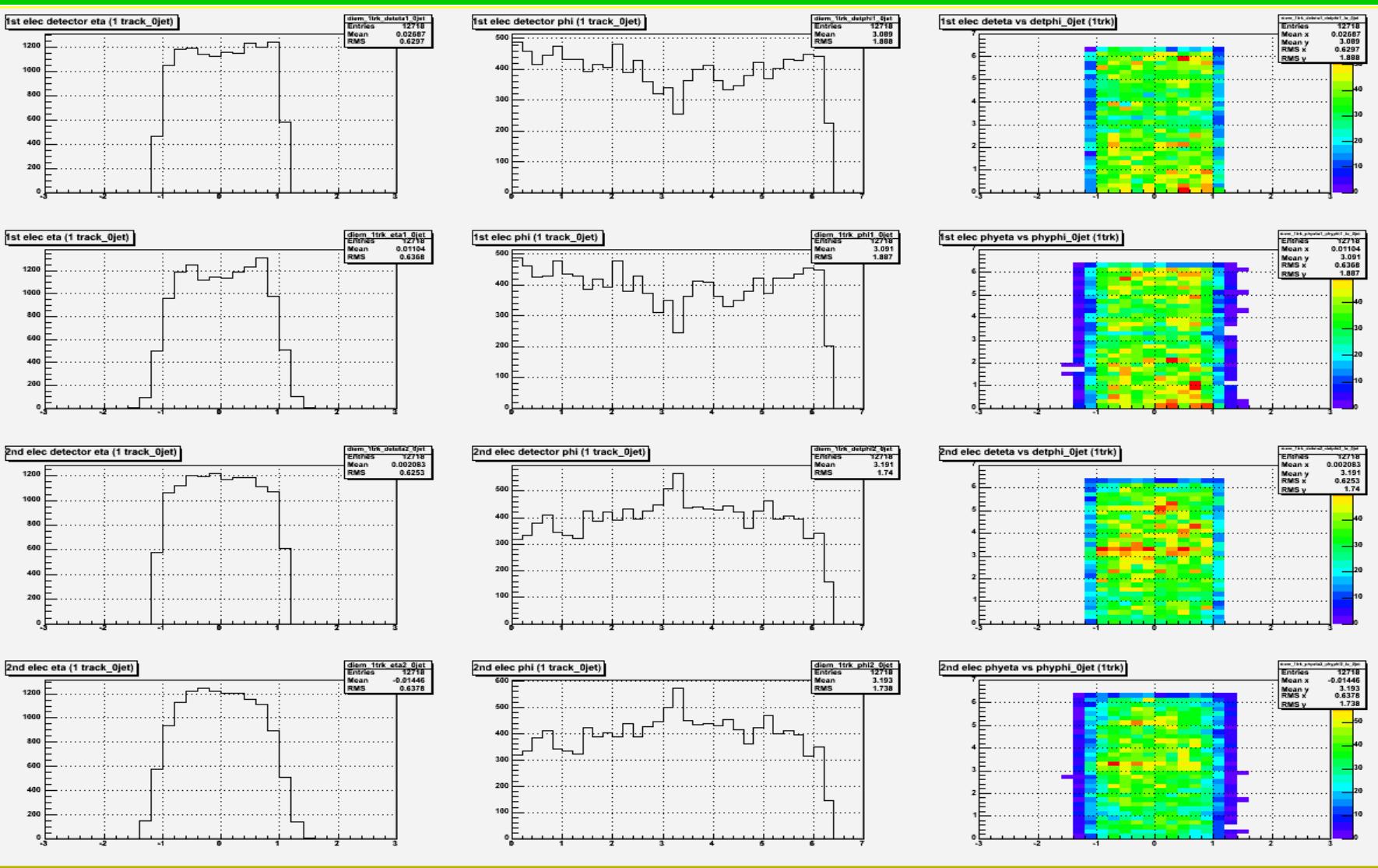
# Electron pT vs Electron Eta (combining both electrons)



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# Applying Analysis Cuts

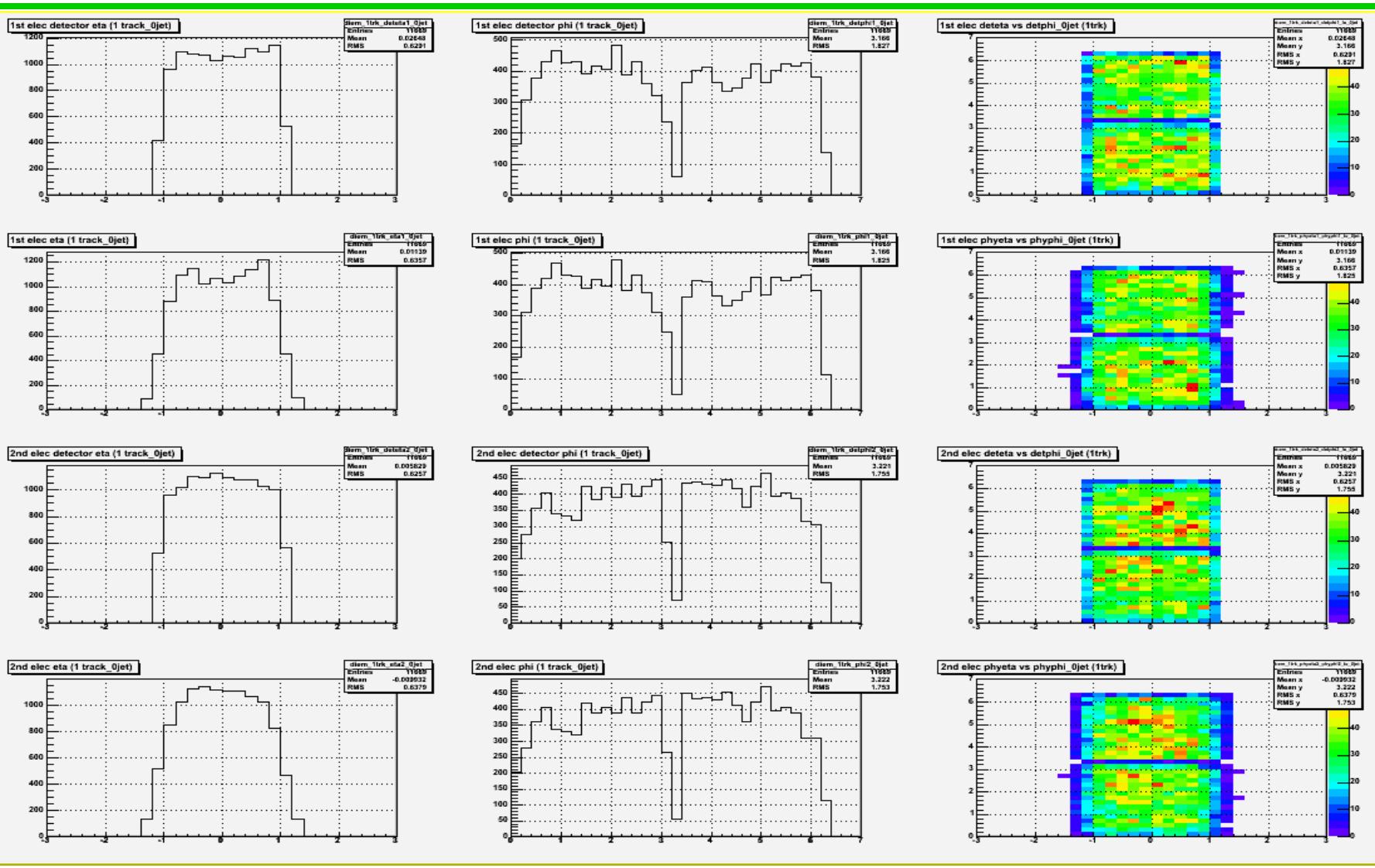


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# Excluding CAL Module 17



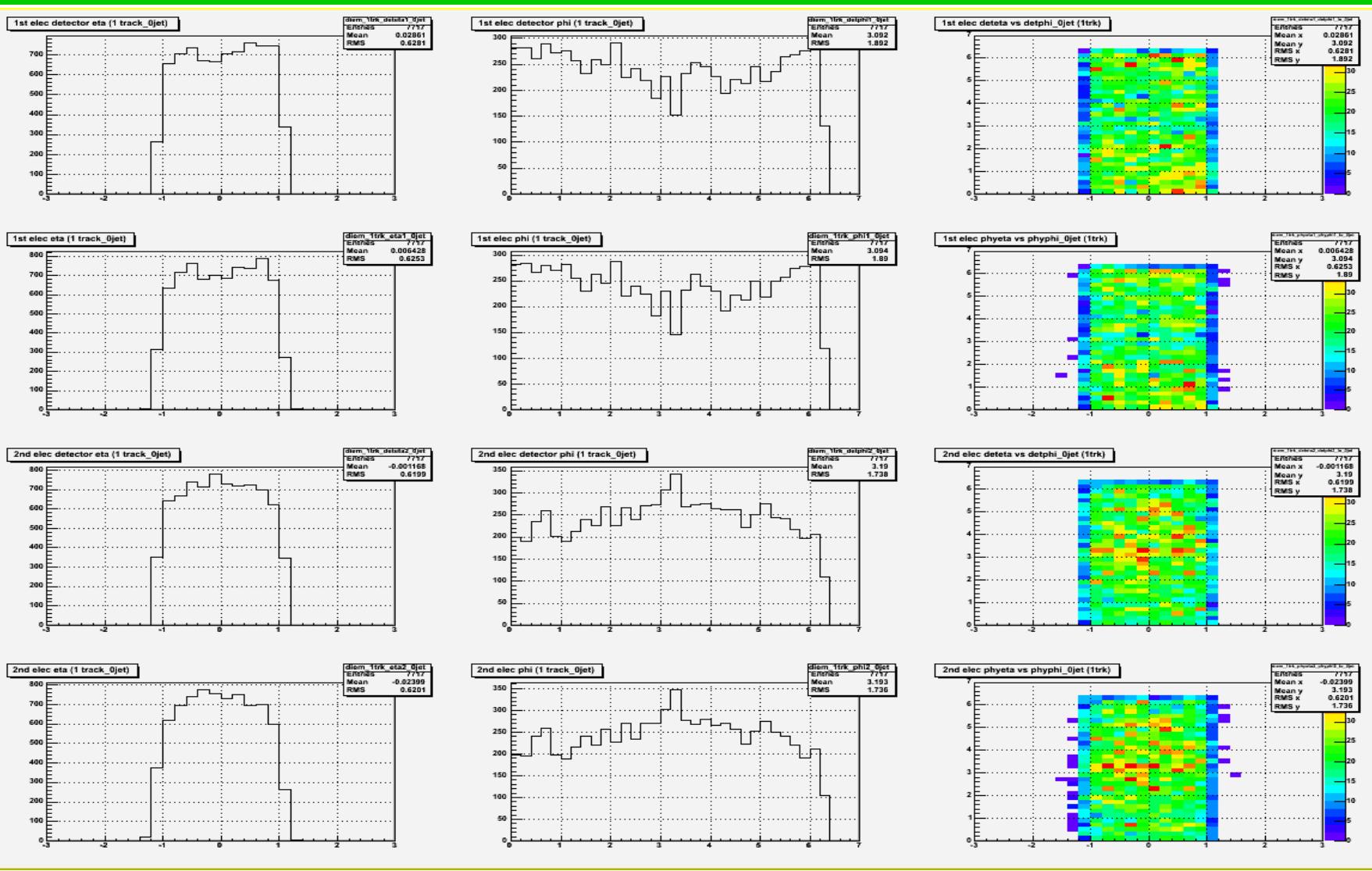
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# $|PVZ| < 20\text{cm}$



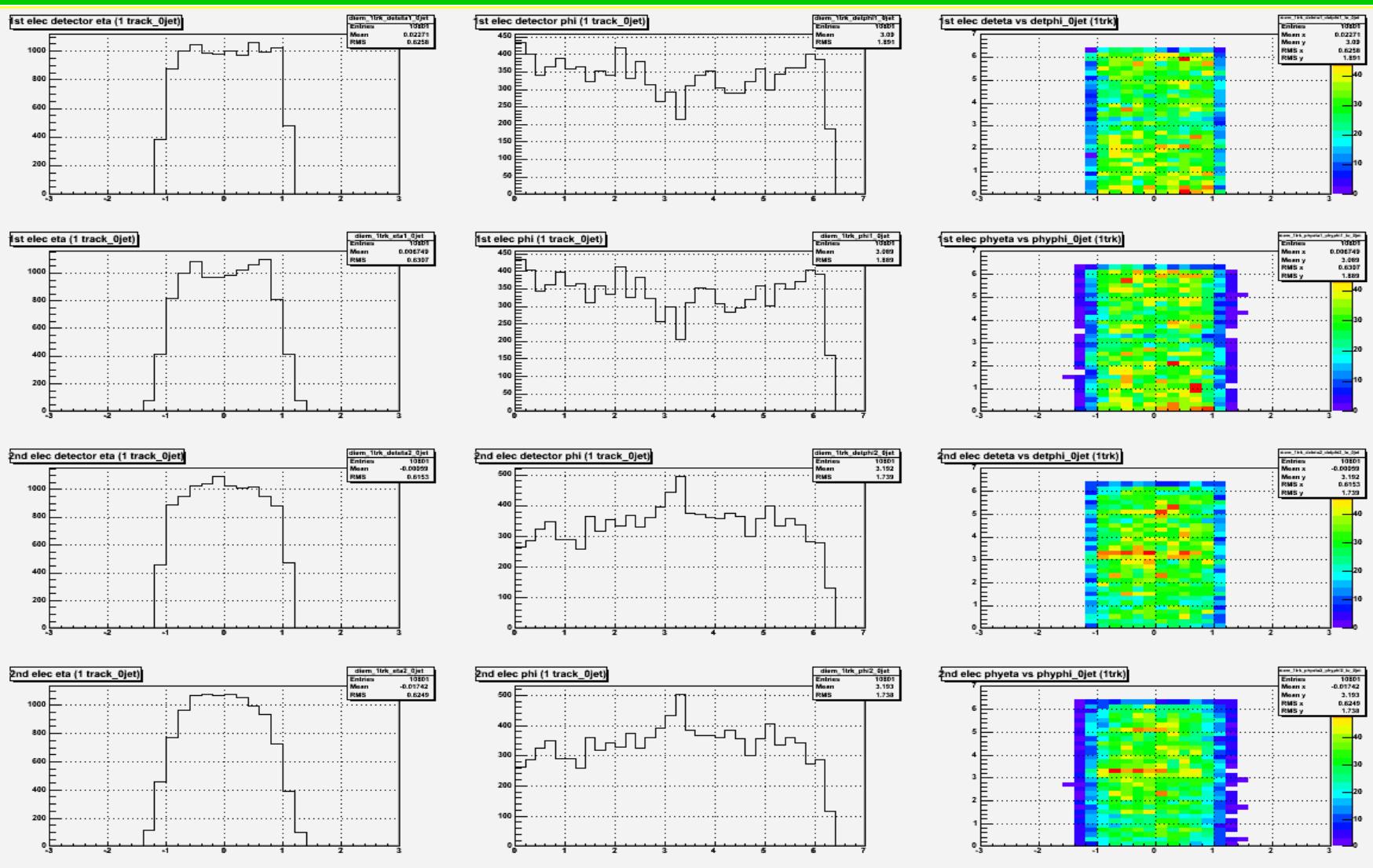
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# Excluding Phi Cracks

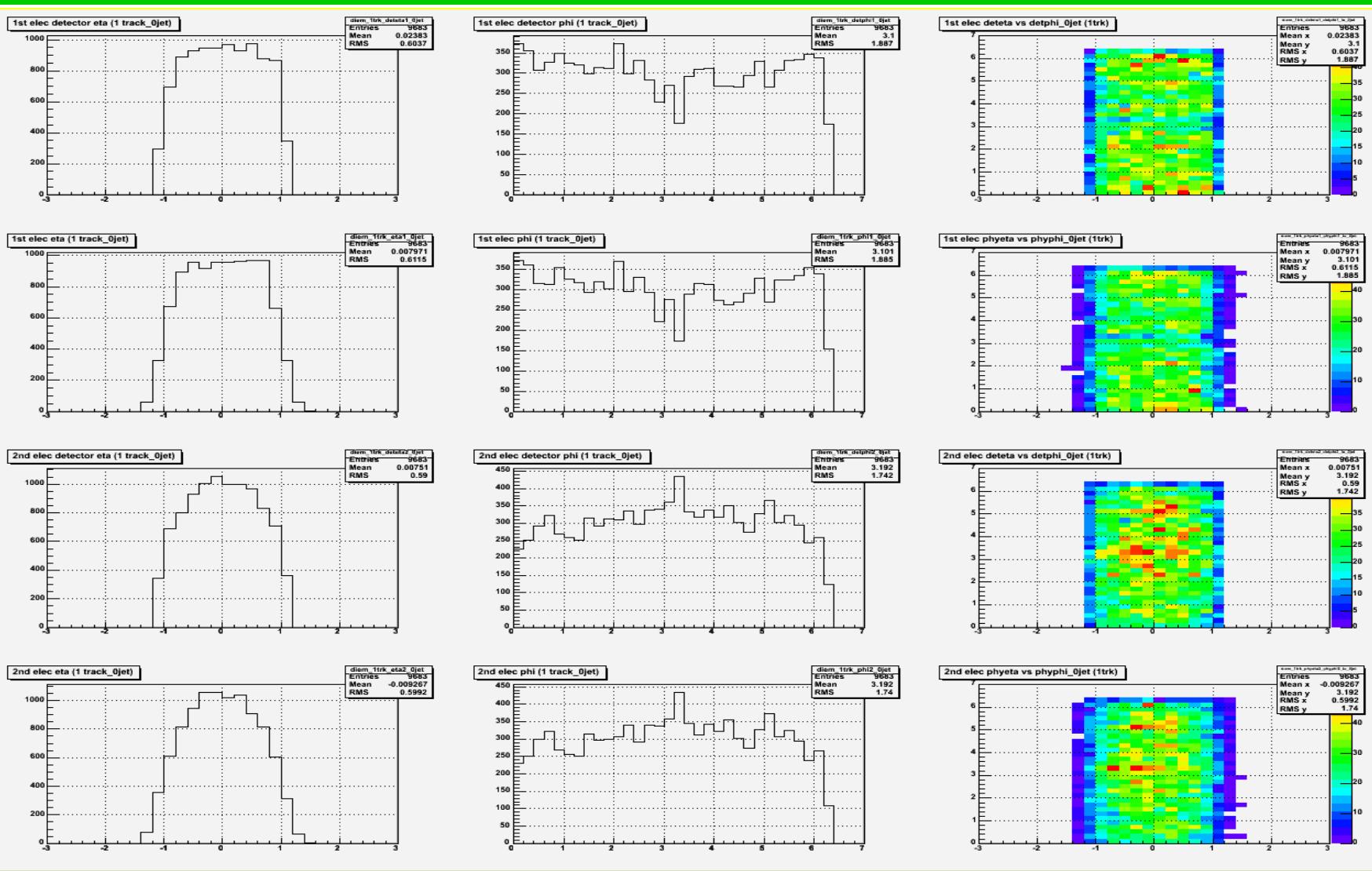


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# Raising Electron pT Threshold: pT>35GeV



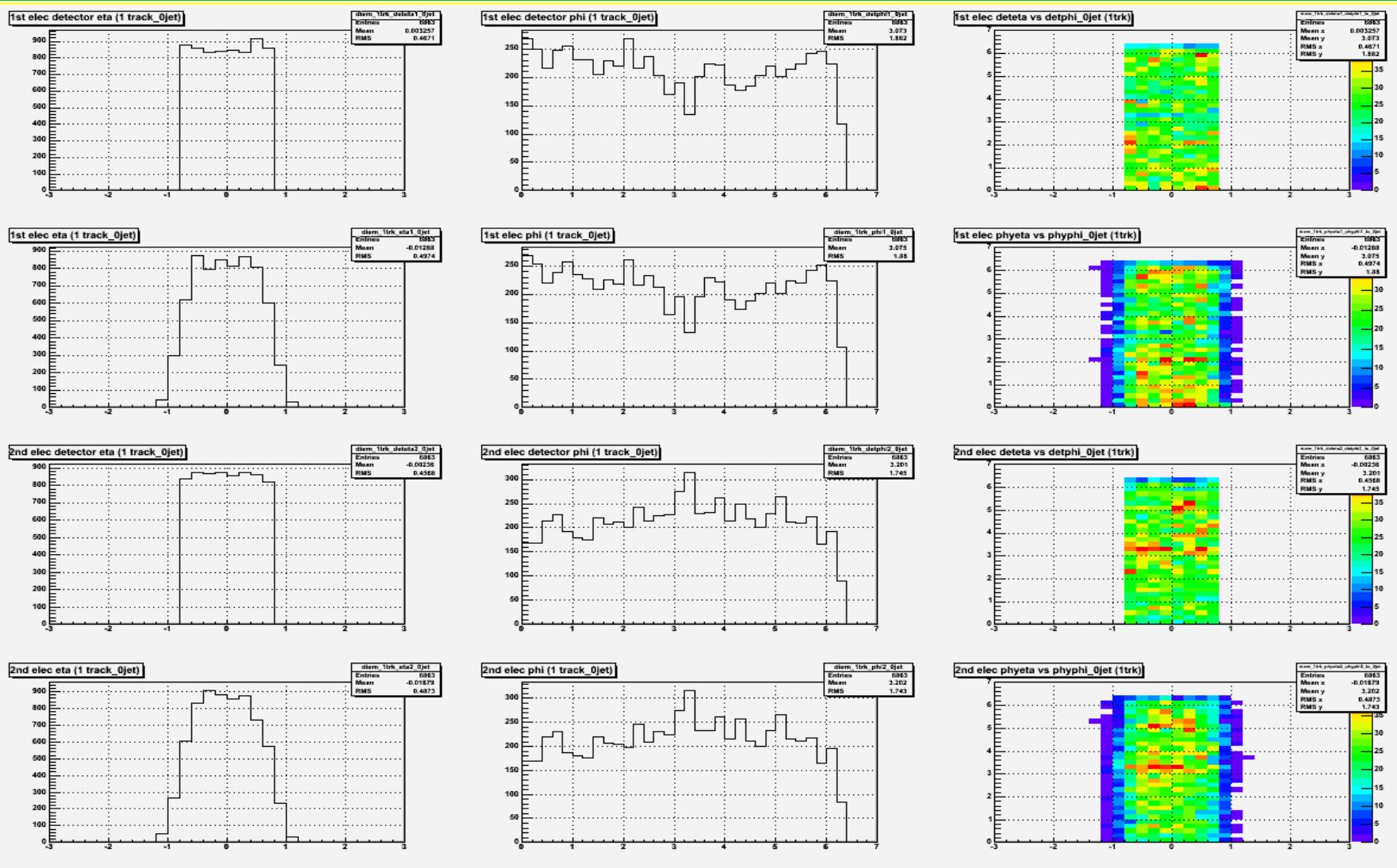
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# Requiring $|\eta| < 0.8$

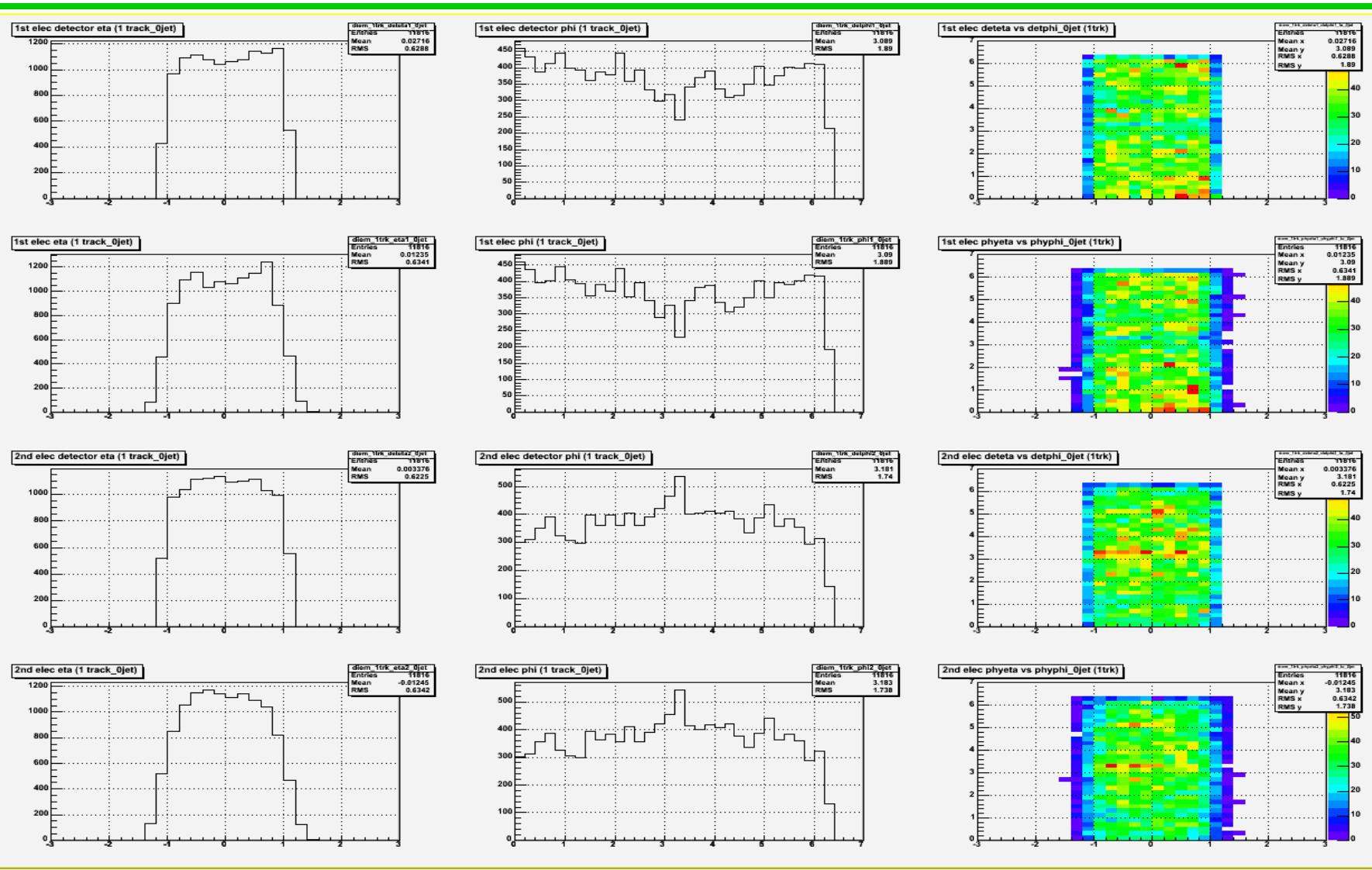


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# Tightening Mass Window: $80\text{GeV} < M_{ee} < 100\text{GeV}$



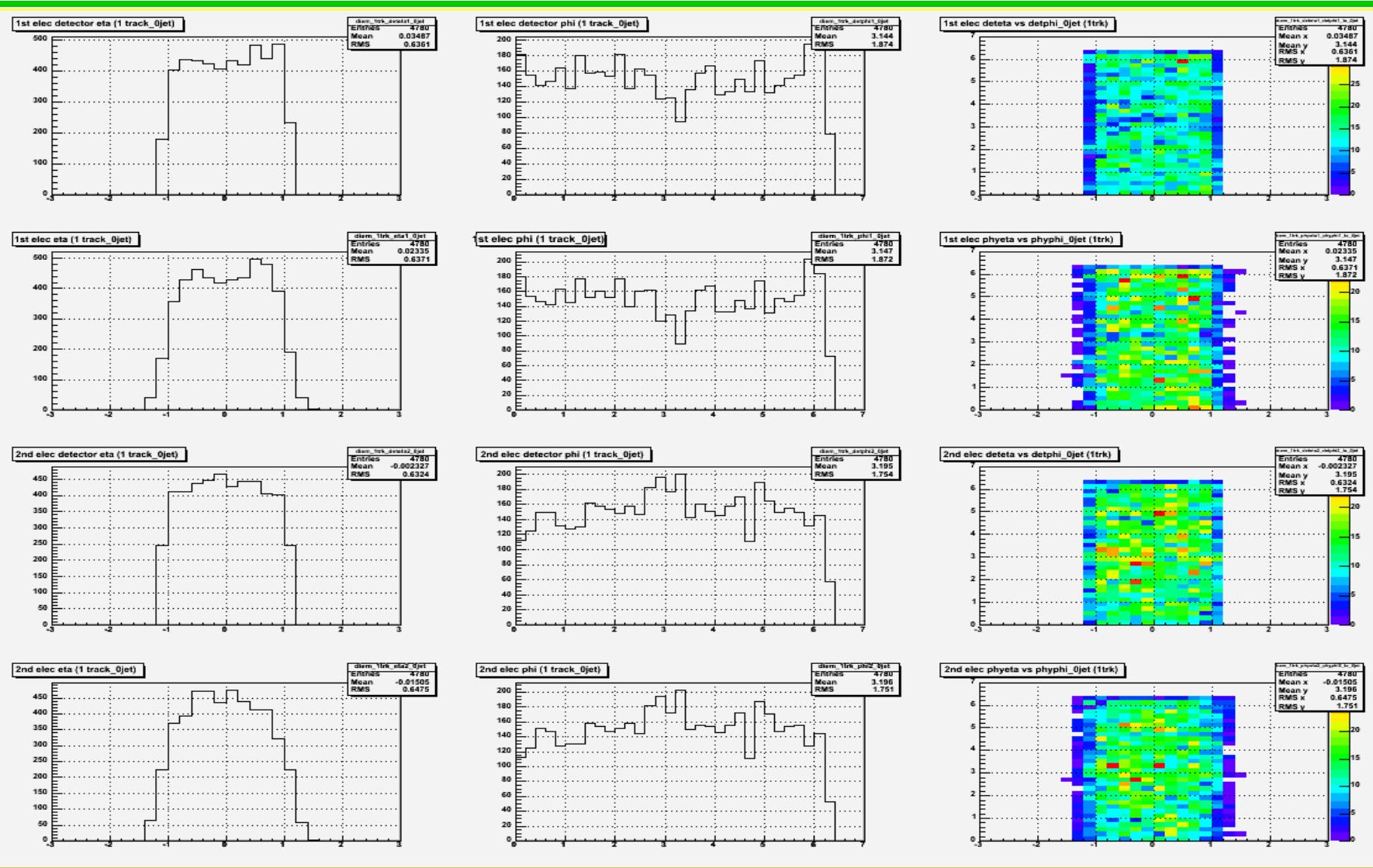
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# Requiring 1 Track Match (exclusively)



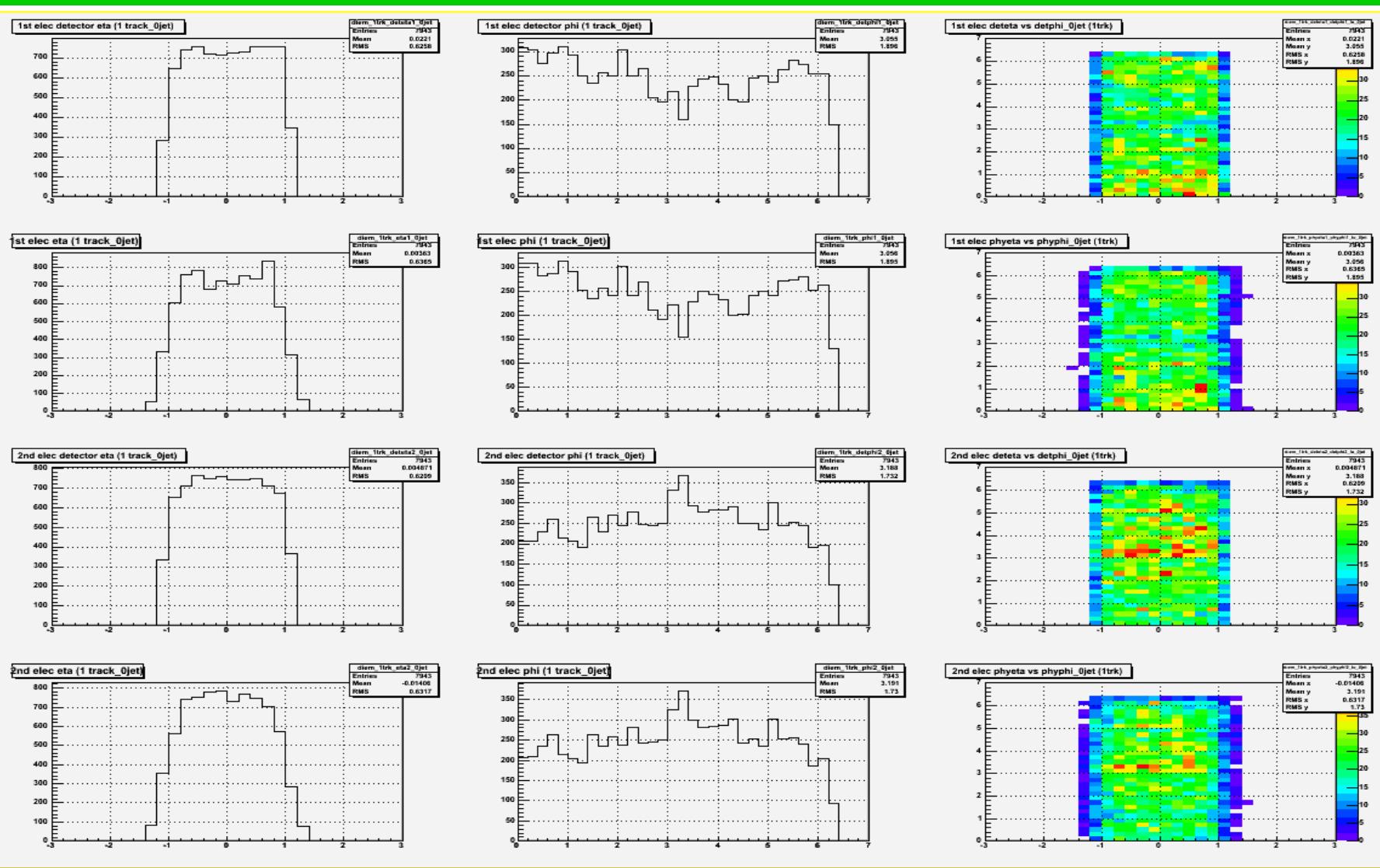
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# Requiring 2 Track Matches (exclusively)



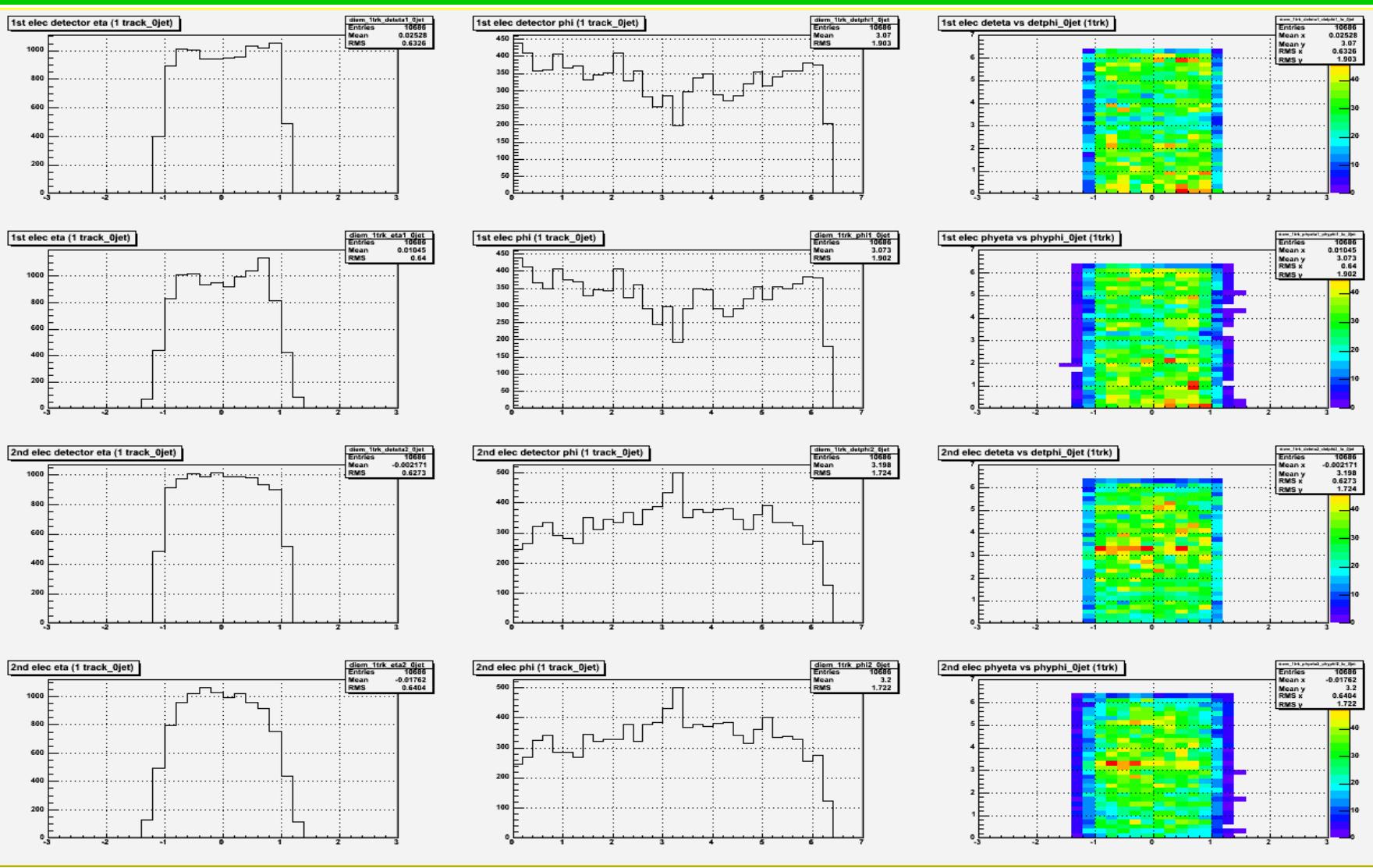
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# Number of Jets = 0 (Exclusively)



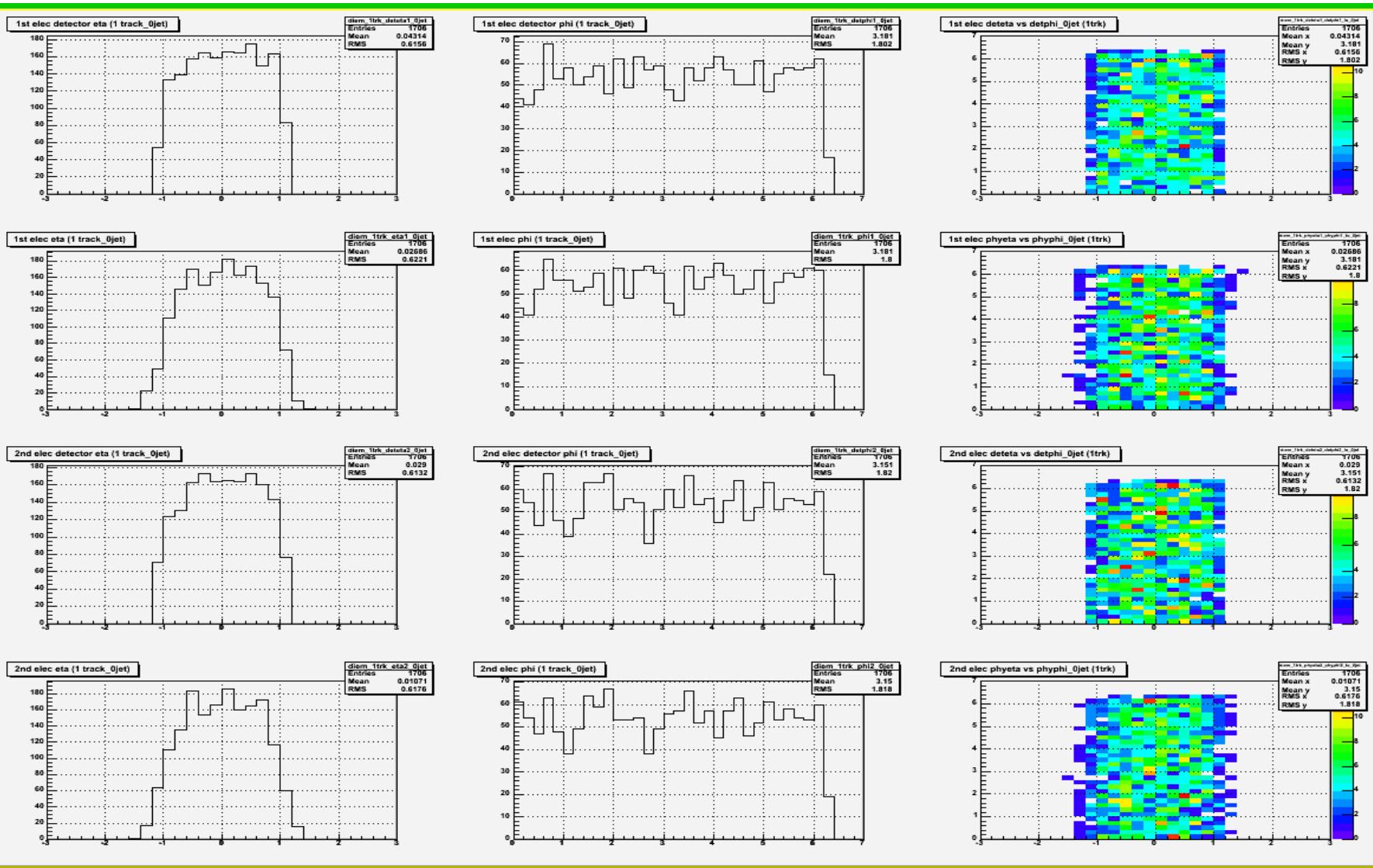
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# Number of Jets = 1 (Exclusively)



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# Number of Jets = 2 (Exclusively)



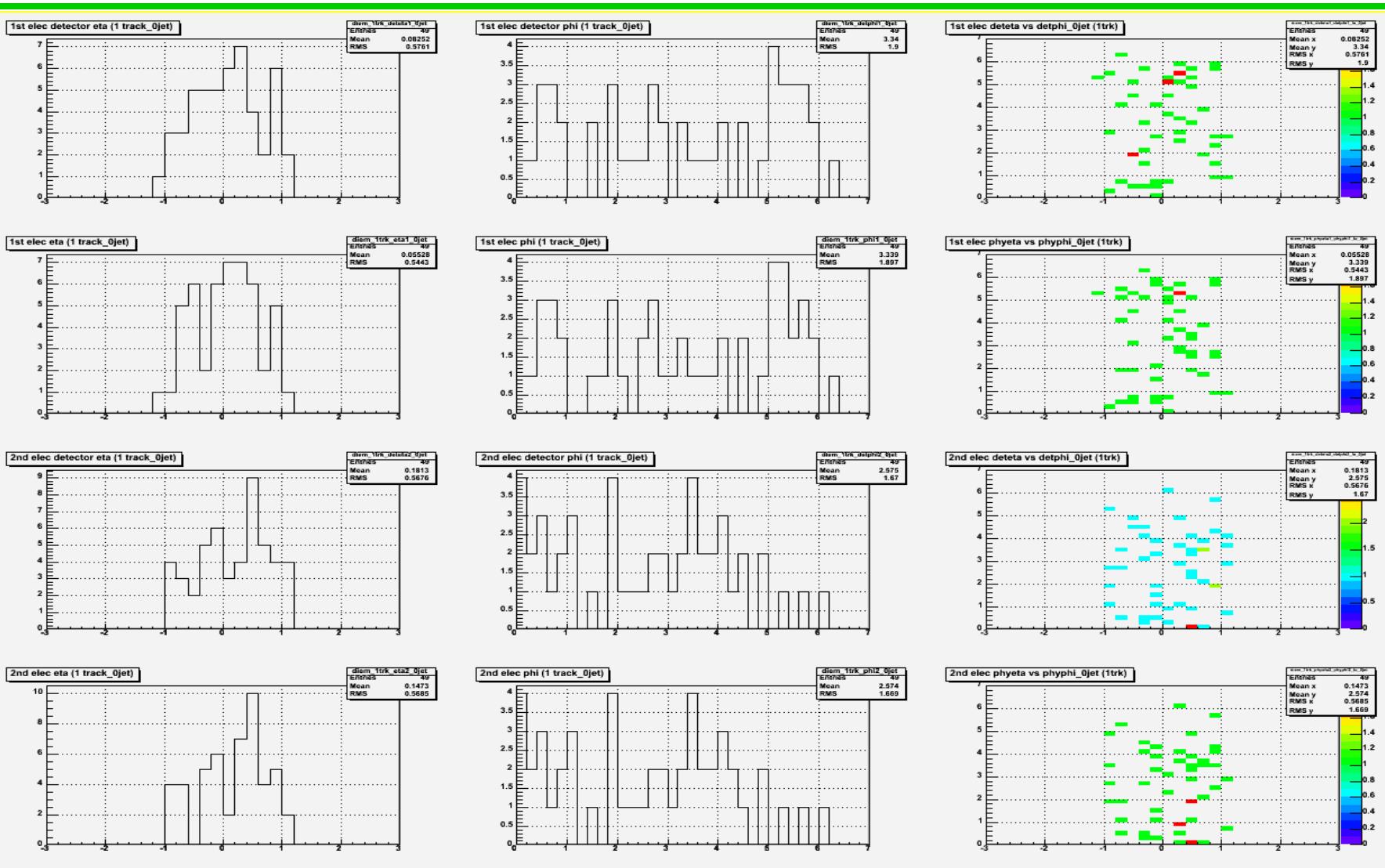
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# Number of Jets = 3 (Exclusively)



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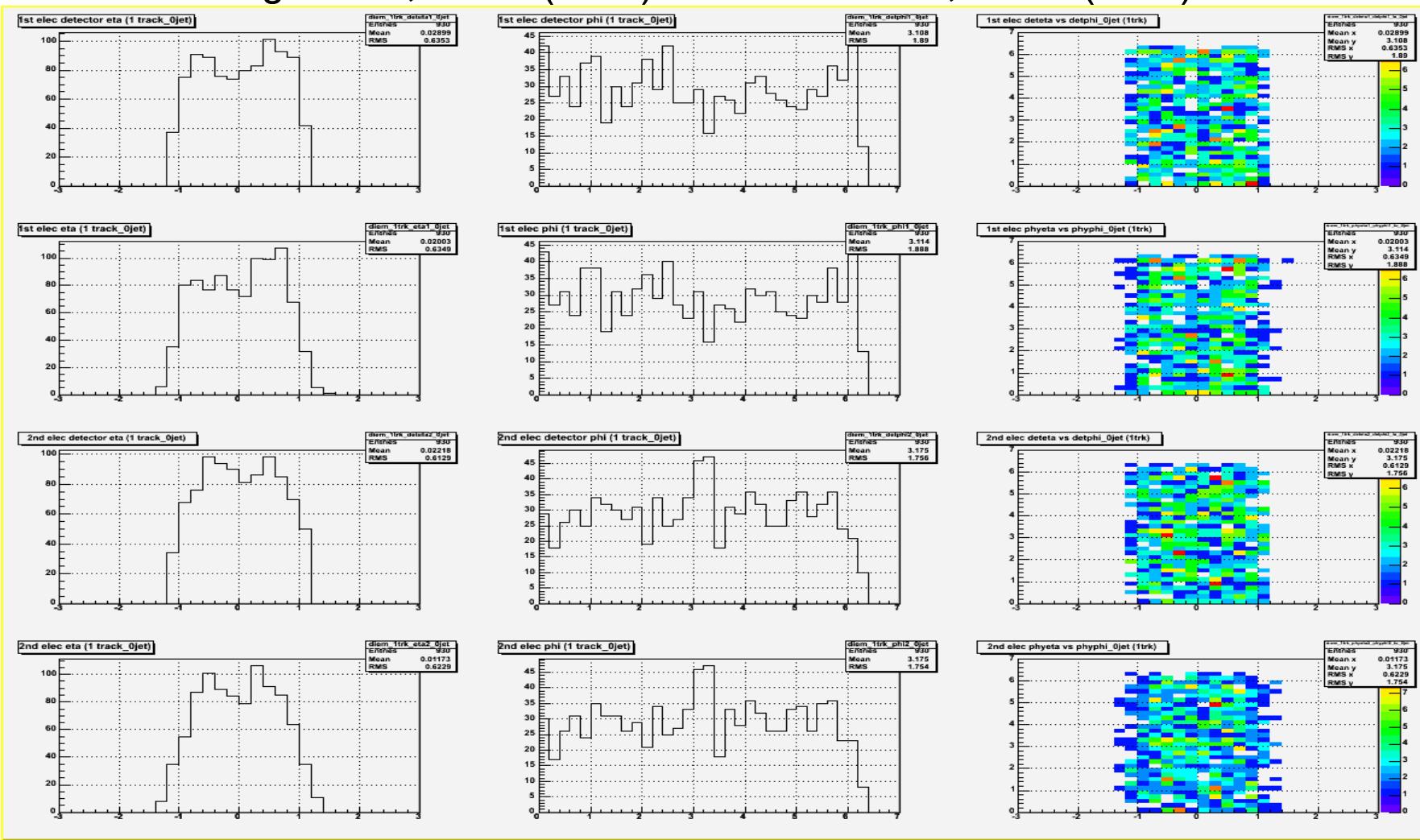
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# Run Range: 161,973 - 168,134

August 15, 2002 (8.10) – November 15, 2002 (9.30)



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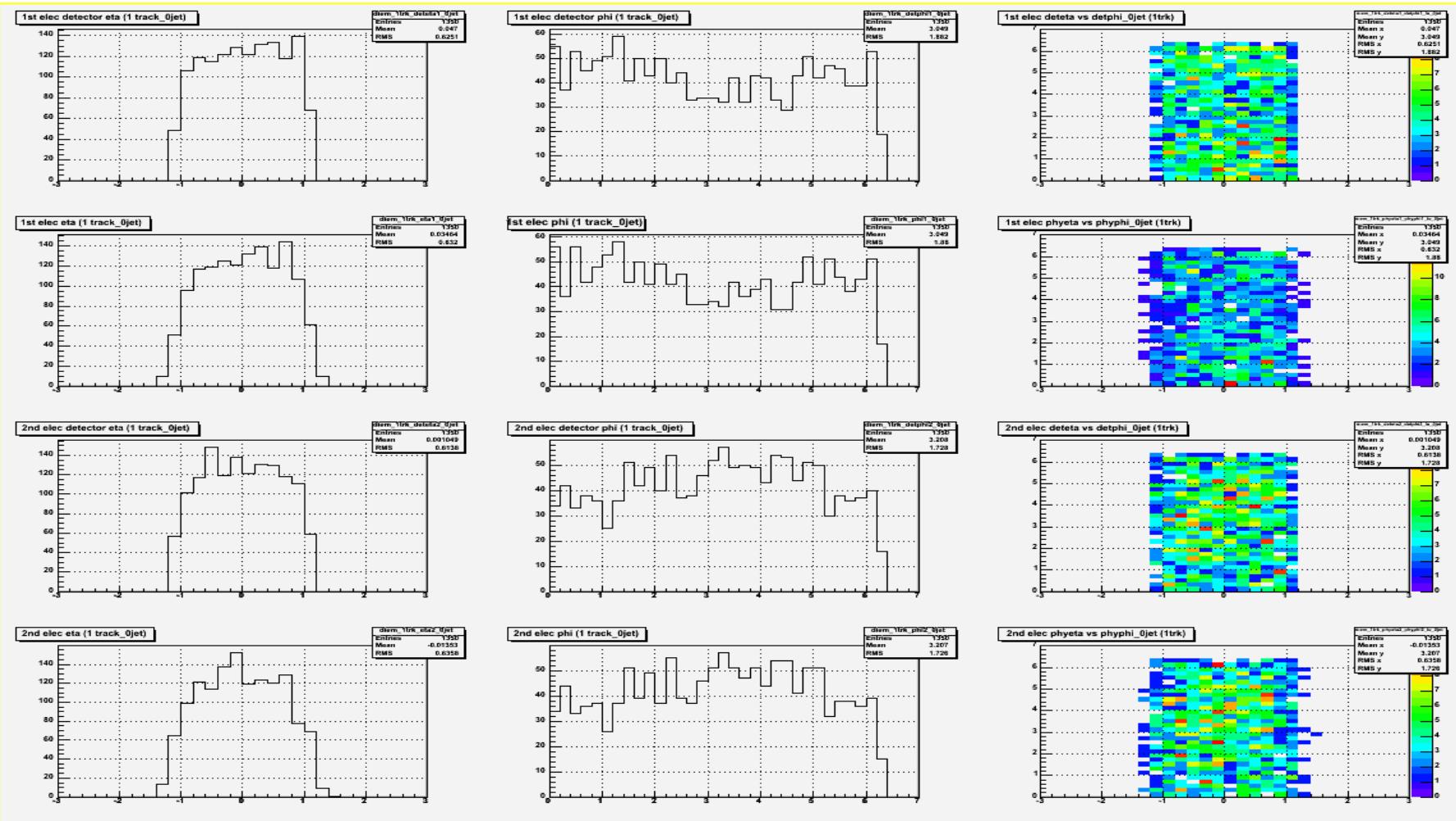
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# Run Range: 168,135-174,495

November 15, 2002 (9.30) – March 20, 2003 (10.35)



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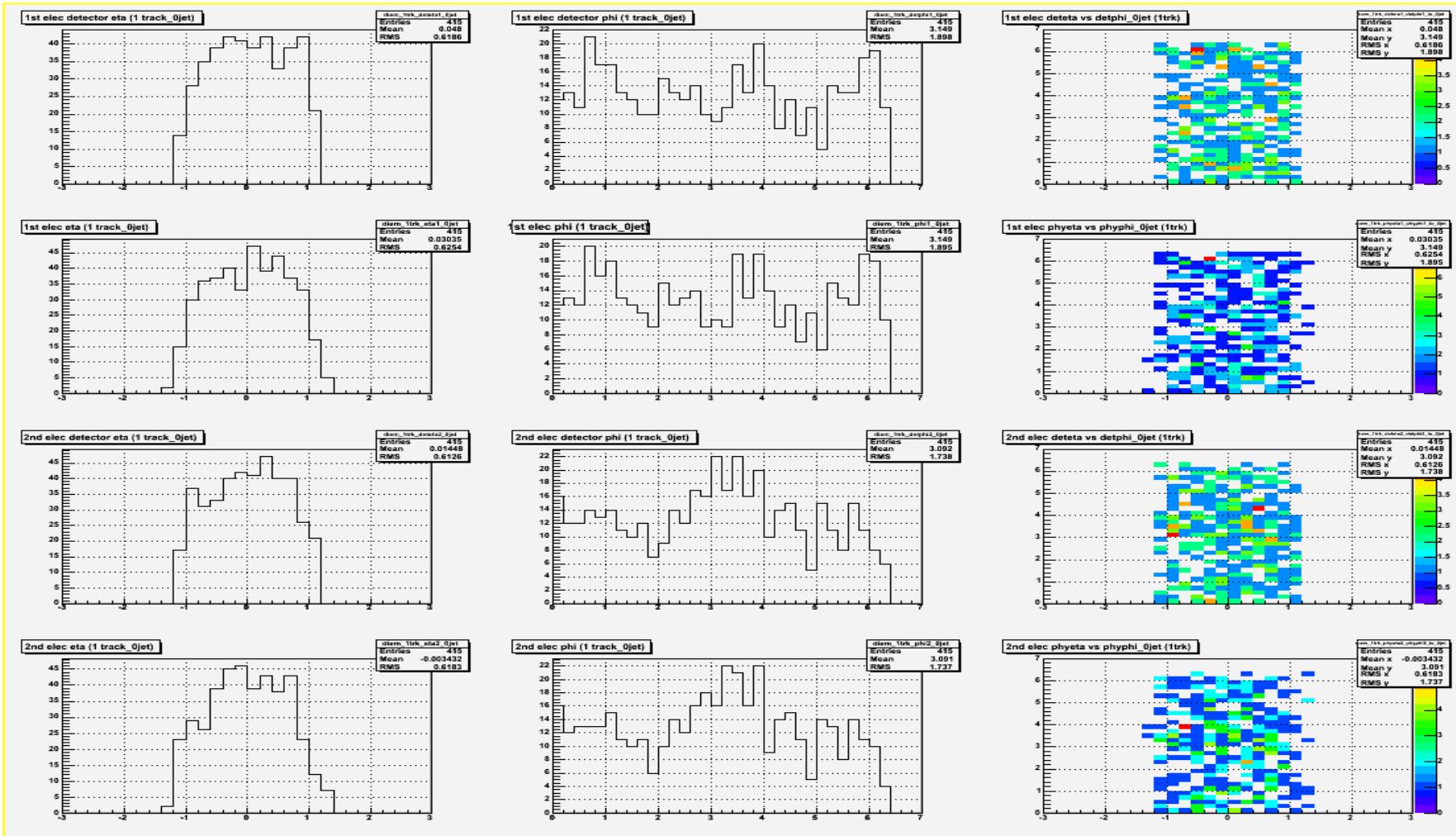
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# Run Range: 174,496-175,819

March 20, 2003 (10.35) - April 17, 2003 (11.03)



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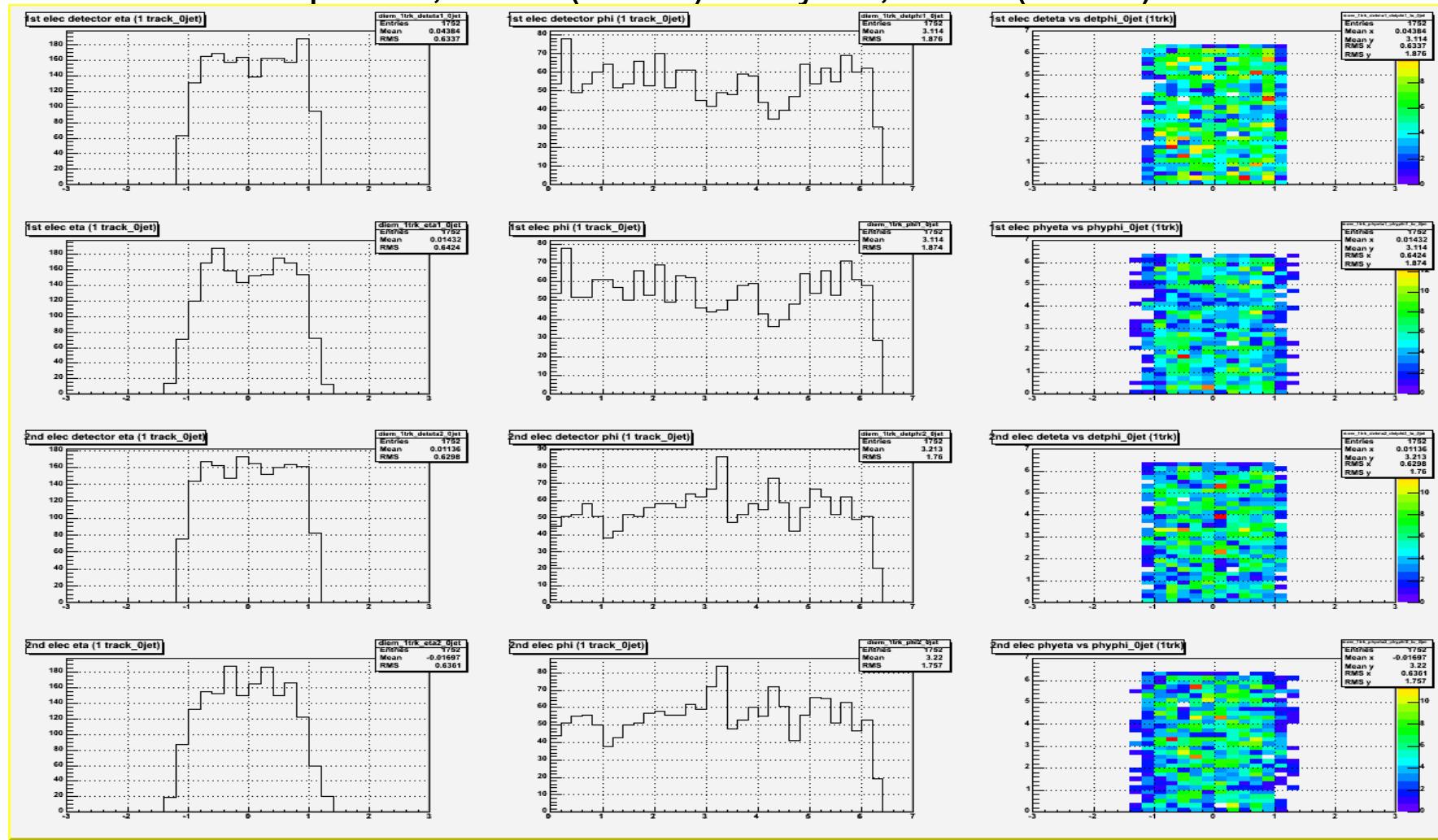
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# Run Range: 175,820-178,788

April 17, 2003 (11.03) – July 10, 2003 (12.10)



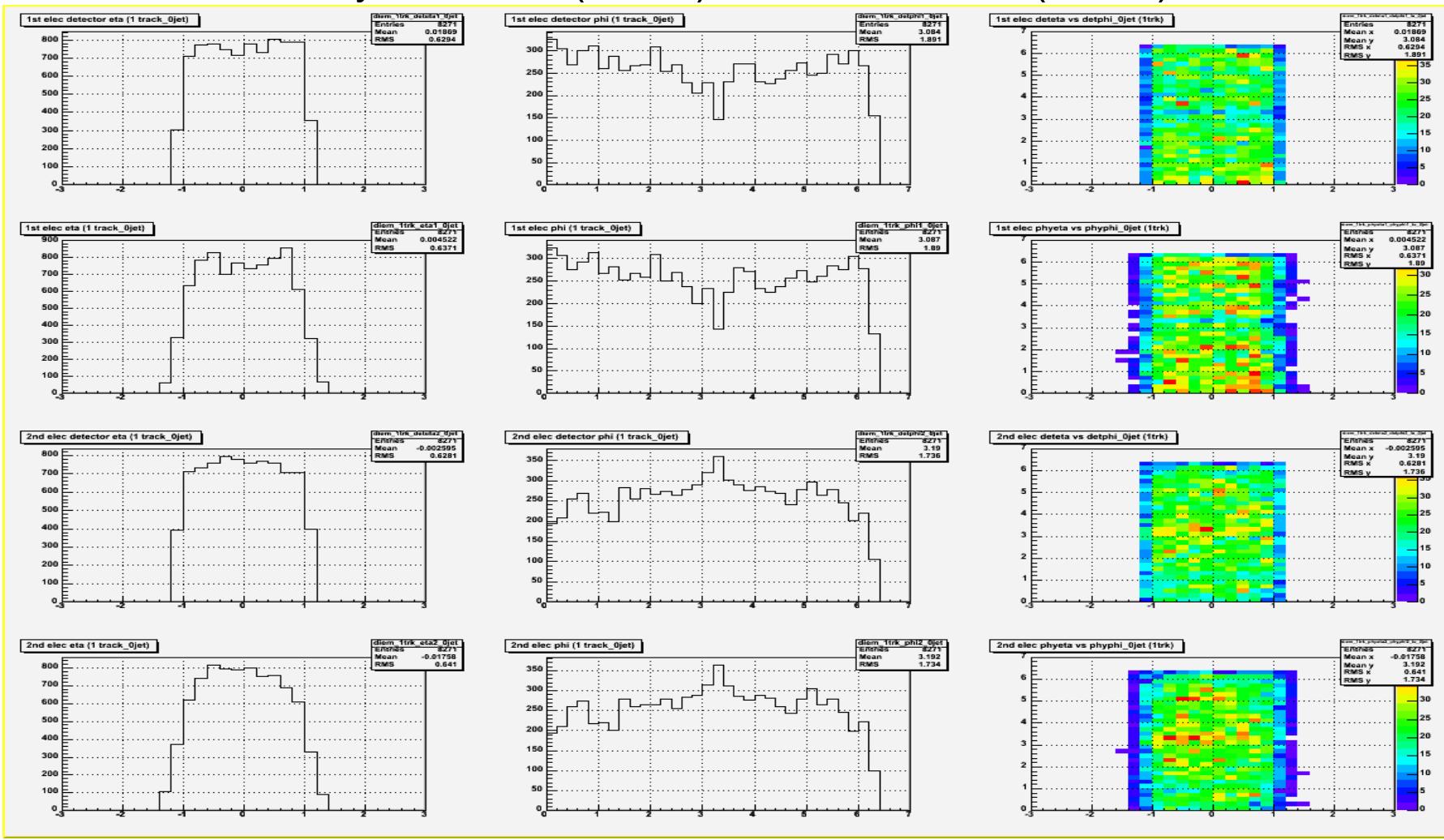
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# Run Range: 178,789-194,566

July 10, 2003 (12.10) – June 29, 2004 (12.37)



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